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(54) **A steering mechanism of a rack and pinion type**

(57) A toothed pinion (1), mounted in a guide body, engages with teeth (3) of a rack (4) longitudinally displaceable in said guide body. A support member (6) is located interposed between the guide body and the rack (4), said support member (6) having a hollow (7) for receiving the portion of the rack bar (4) opposite to said teeth (3). The support member (6) has flexible portions (9′, 9′) at least partly around and in contact with said rack bar (4) without contacting said guide body, and supported by a control spring (12) to maintain the flexible portions (9′, 9′) in contact with said rack bar (4) whilst permitting controlled bending in a direction radial to the axis of said rack bar (4).

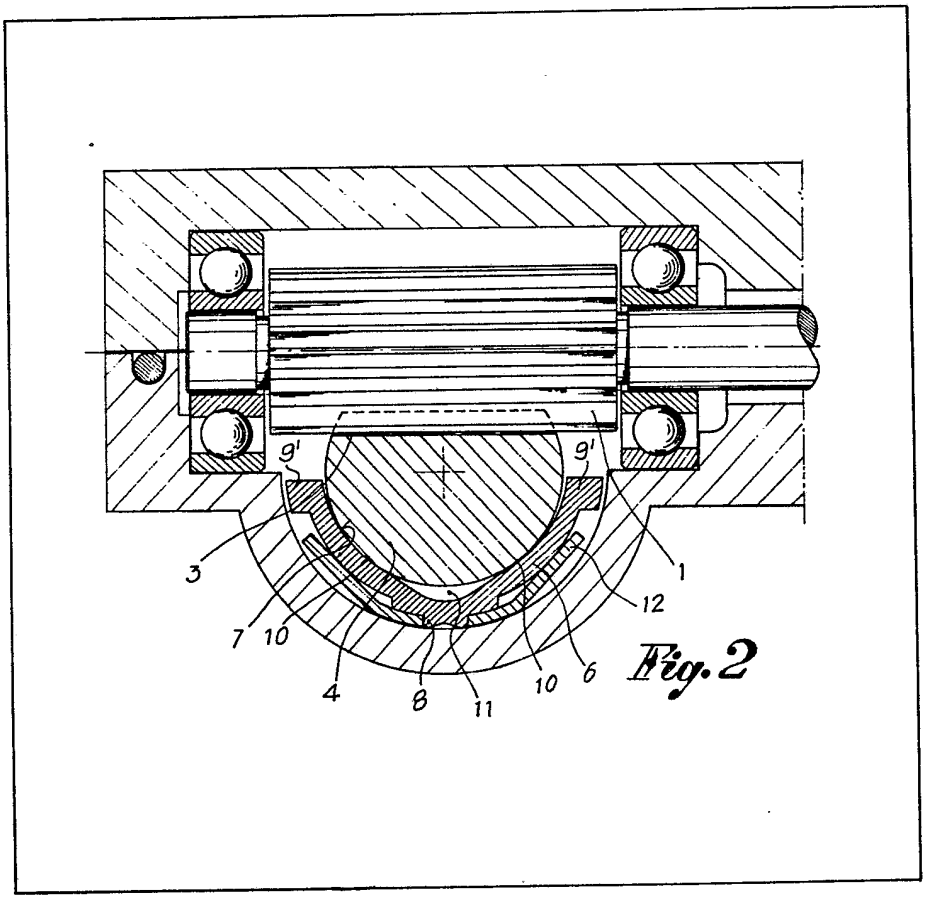

Fig. 2

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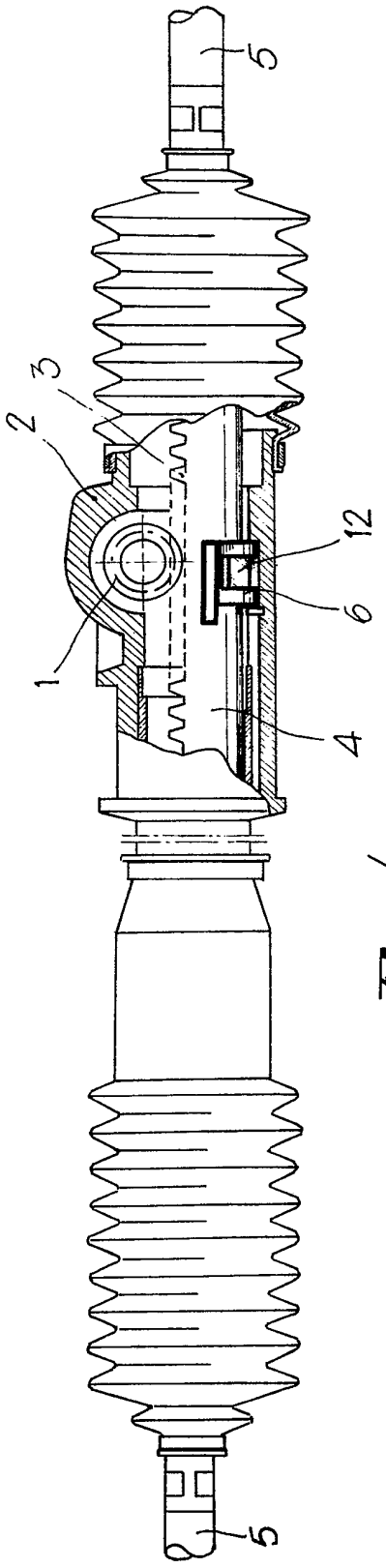

Fig. 1

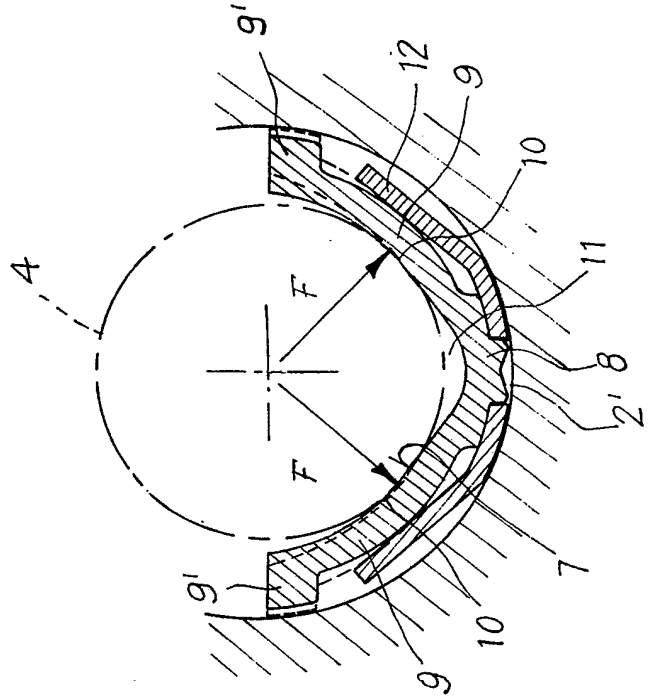

Fig. 3

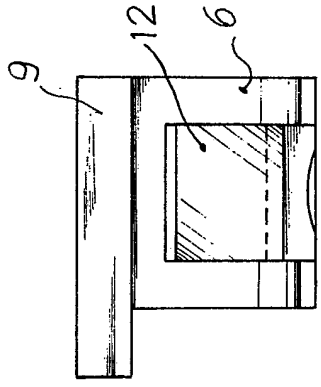

Fig. 4

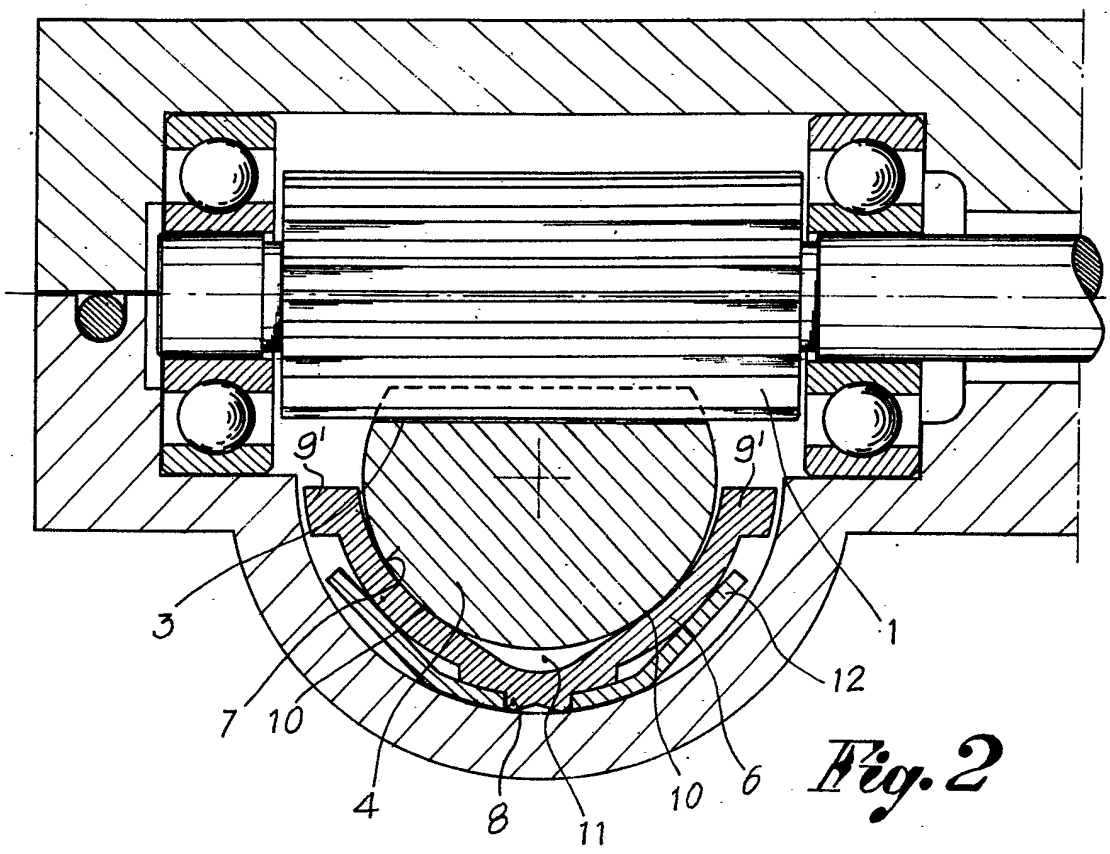

Fig. 2

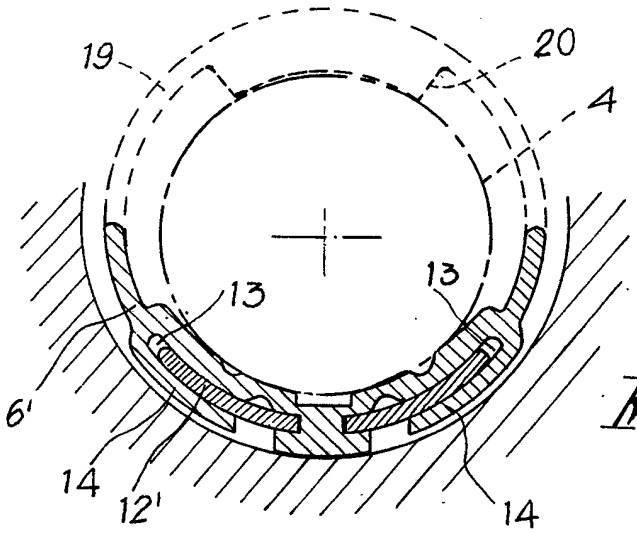

Fig. 5

SPECIFICATION

Improved steering mechanism for automotive vehicles

The present invention concerns an improved steering mechanism for automotive vehicles, said mechanism being of the type having a pinion and rack unit and, more particularly, concerns resilient means for ensuring constant and correct engagement between pinion and rack for the purpose of eliminating influences due to shocks and play originating from wear.

Steering mechanisms of the above-mentioned type in general comprise a toothed pinion mounted to rotate in an associated box and engaging with the teeth of a rack bar axially displaceable in an associated guide tube and connected to the track rods of the wheels of the vehicle.

In order to ensure correct engagement of the control pinion with the rack bar to be controlled, solutions have already been proposed which provide for the use of substantially fork-like elastic support means of rubber or plastics material acting on the rack bar in opposition to the radial thrusts of the pinion on the bar itself. Therefore, to integrate the action of said support means, it has also been proposed to associate therewith a helical spring in order to ensure resilient contact, with pre-determined intial tension of the means themselves with the rack so as to suitably support said rack and to absorb thrusts, bendings and the like. In all solutions hitherto proposed, the resilient means have been retained in an associated recess and forced to suffer a displacement or elastic deformation in only one direction and, more precisely, in the direction of the axis of said members corresponding to a radial direction of the rack. In fact, however, such a structure is not suitable for fully developing the function for which it is provided, other than by rendering the execution more complicated and laborious than might have been expected.

The object of the present invention is to provide a steering mechanism with means for resiliently supporting the rack bar and capable of elastic deformations in at least two different radial directions as a result of a controlled divergence of two portions coming into contact with opposing parts of the rack bar, said deformation being controlled by cup-type springs and defined by fixed shoulders co-ordinated with said portions.

Another object of the present invention is to provide a steering mechanism having elastic means for supporting the rack bar, actuated in a simple and economical manner, readily applied to the unit and able to maintain correctly engagement between the pinion and the rack bar, to absorb shock forces applied thereto, whilst permitting the bar to effect correct axial displacements and to compensate play due to tolerances of manufacture and assembly, apart from compensating play due to wear on the coupling.

According to the present invention there is provided a steering mechanism for automotive vehicles, comprising a toothed pinion mounted to rotate in a guide body and engaging with the teeth of a rack bar longitudinally displaceable through said guide body and connected to the track rods of the wheels of the automotive vehicle, wherein between said rack bar and said guide body there is interposed at least one support member of plastics material defining a hollow for receiving the part of said rack bar opposite to its teeth and having two flexible portions extending from two opposite parts and in contact with said rack bars without being in contact with the bar whilst permitting control bending thereof in a radial direction relative to the axis of said rack bar.

The present invention will be described further by way of example with reference to the accompanying drawings, in which:—

Fig. 1 shows a steering mechanism assembly in partial longitudinal section;

Fig. 2 shows a cross-section of the mechanism of Fig. 1 through the elastic support means;

Fig. 3 shows a section taken through a single elastic support means according to a first embodiment.

Fig. 4 shows a side view of the member shown in Fig. 3, and;

Fig. 5 shows a section through a variant of the support member.

In the drawings, a pinion 1 is mounted to rotate in a guide body 2 and engages with the teeth 3 of a rack bar 4 capable of axial displacement in a longitudinal direction through said guide body 2, said pinion 1 being controlled by the shaft of the steering wheel of the vehicle, whilst the ends of the rack bar 4 are connected to track rods 5 of the steering arms (not shown) acting on the wheels of the vehicle.

The rack bar 4 has at least one elastic support member 6 associated therewith defining a hollow 7 for receiving the cylindrical part of the rack bar 4 opposite to the teeth 3 co-operating with the pinion 1. Said support member 6 is inserted in the guide body 2 of the rack bar 4 so as to be prevented both from rotating and from being axially displaced during the movements of the bar 4 itself.

The support members 6 is punched out of suitable relatively flexible plastics material having a support base 8 or the like, engaging the inner surface 2′ of the guide body 2 and located between two flexible portions 9, 9 extending around the sides of the rack bar 4 without contacting the inner surface 2′ of said body 2.

The portions 9, 9 being able to execute flexional displacements, in the direction of the arrows F in Fig. 3, with their fulcrum on the base or support 8. On the other hand, the surface of the hollow 7 in the support member 6 has portions with different radii in order to define two zones of support 10, 10 for the rack bar 4, between which there is at least one space 11, said zones of support 10, 10 being associated with a central part of the flexible portions 9, 9 whilst said space 11 is in the region of the base 8 or below the

rack bar 4.

A spring 12 is located on the base 8 of the support member 6, externally thereof, which spring 12 extends to and engages with the flexible portions 9, 9 so as to keep these portions in contact with the rack bar 4, whilst permitting controlled bending thereof when subjected to radial forces transmitted by said bar 4. The spring 12 is suitably adjusted and mounted with an initial tension determined as a function of the reaction which it is desired to obtain to forces transmitted by the rack bar 4 or to correct play and defects of construction and assembly thereof with respect to the pinion 1 and the guide body 2.

In any case, abnormal radial thrusts, or defects in the construction of the unit, rebound on each other and from time to time are absorbed by the support member 6 with control spring 12 so as to maintain a constant and correct engagement between pinion 1 and rack 4. In fact, the possibility of resilient divergence of the flexible parts 9, 9 of the support member 6 and the resilient reaction thereof after each divergence, ensured by the control spring 12, always contributes to maintaining the correct inter-axis and predetermined coupling force between the pinion 1 and the rack bar 4 for correct action thereof without interruptions and automatic compensation for play due to wear.

It should be noted that, whilst the reaction of the spring 12 in the direction of the displacement of the teeth of the rack 4 towards the pinion 1 is only opposed by the coupling forces, the divergence of the flexible portions 9, 9 of the support members is limited in order to prevent any disengagement between pinion 1 and rack 4 and to contain the bending of the spring 2 in order to prevent breakage thereof. This limitation of movement of the portions 9, 9 is obtained, for example, by providing enlarged stop members 9', 9' on the support member 6 itself and intended to bear against the inner surface 2' of the guide body 2 when the member 6 is subjected to the maximum divergence admissible.

Fig. 5 of the drawings shows an alternative construction of the support member 6' which, whilst the features and essential objects described above remain the same, has a control spring 12' having its ends secured in corresponding recesses 13 defined by fins 14 of the member 6', and means for limiting bending, said means being represented by the same fins 14 intended to bear against the inner surface of the guide body 2 upon reaching the maximum bending admissible.

Such a solution offers the advantage that, in the event of a breakage of the spring 12', the fragments are retained on the support member 6' without the possibility of them dropping into the space for the rack 4 and the pinion 1 so as to avoid irreparable damage to the unit.

Whilst, in the attached drawings, the support member 6, 6' is shown as semi-cylindrical, it could be substantially cylindrical, in the sense that the free ends of the flexible parts 9, 9 may be interconnected or the like by at least one continuous or interrupted band (connection) 19 encircling the rack 4 (see broken lines in Fig. 5) and having a coated portion 20 acting on the rack in opposition to the action of said flexible portions 9, 9.

CLAIMS

1. A steering mechanism for automotive vehicles, comprising a toothed pinion mounted to rotate in a guide body and engaging with the teeth of a rack bar longitudinally displaceable through said guide body and connected to the track rods of the wheels of the automotive vehicle, wherein between said rack bar and said guide body there is interposed at least one support member of plastics material defining a hollow for receiving the part of said rack bar opposite to its teeth and having two flexible portions extending from two opposite parts and in contact with said rack bars without being in contact with the inner surface of said guide body, and an initially tensioned, control spring is associated with said semi-cylindrical element and engaging on said flexible portions in order to keep them in contact with the rack bar whilst permitting control bending thereof in a radial direction relative to the axis of said rack bar.

2. A steering mechanism according to Claim 1, wherein said support member has a support base engaging on the inner surface of the guide body of the rack bar, said base representing both the fulcrum for the bending of the flexible portions and the means of application for the control spring.

3. A steering mechanism according to Claim 1, wherein said control spring is secured to the base of the support member and freely acts against the flexible portions of the member.

4. A steering mechanism according to Claim 1, wherein said control spring is secured to the base of the support member and has its ends located in corresponding recesses formed on the flexible portions of the member said recesses being defined by protective fins.

5. A steering mechanism according to Claims 1 and 2, wherein the ends of the flexible portions of the support member are interconnected or the like by at least one band with covered portions acting on the rack in opposition to the action of said flexible portions.

6. A steering mechanism according to Claim 1, wherein said support member has means for limiting the bending of the flexible portions, said means bearing against the inner surface of the guide body of the rack bar when said portions reach maximum admissible bending.

7. A steering mechanism substantially as herein described with reference to and as illustrated in the accompanying drawings.

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